

## **Title: Powerful Patterns**

### **Brief Overview:**

These performance-based activities integrate language arts, technology and the study of patterns. The students will organize information, work cooperatively, use computers to develop a function table, and create a story slide show using the Kid Pix computer program.

### **Links to NCTM 2000 Standards:**

- **Standard 1: Number and Operation**

Mathematics instructional programs should foster the development of number and operation sense so that all students understand numbers, ways of representing numbers, relationships among numbers, and number systems; understand the meaning of operations and how they relate to each another; and use computational tools and strategies fluently.

- **Standard 2: Patterns, Functions, and Algebra**

Mathematics instructional programs should include attention to patterns, functions, symbols, and models so that all students understand various types of patterns and functional relationships; and use mathematical models and analyze change both real and abstract contexts.

- **Standard 6: Problem Solving**

Mathematical instructional programs should focus on solving problems as a part of understanding mathematics so that all students build new mathematical knowledge through their work with problems; develop a disposition to formulate , represent , abstract, and generalize situations within and outside mathematics; and apply a wide variety of strategies to solve problems and adapt the strategies to new situations.

- **Standard 7: Reasoning and Proof**

Mathematics instructional programs should focus on learning to reason and construct proofs as part of understanding mathematics so that all students recognize reasoning and proof as essential and powerful parts of ,mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proofs; and select and use various types of reasoning.

- **Standard 8: Communication**

Mathematical instructional programs should communicate to foster an understanding of mathematics so that all students organize and consolidate their mathematical thinking to communicate with other; express mathematical ideas coherently and clearly to peers, teachers, and others; extend their mathematical knowledge by considering the thinking and strategies of others; and use the language of mathematics as a precise means of mathematical expression.

- **Standard 9: Connections**

Mathematical instructional programs should emphasize connections to foster an understanding of mathematics so that all students recognize and use connections among different mathematical ideas; understand how mathematical ideas build on one another to produce a coherent whole; and recognize, use, and learn about mathematics in contexts outside of mathematics.

- **Standard 10: Representation**

Mathematical instructional programs should emphasize mathematical representations to foster an understanding of mathematics so that all students create and use representation to organize, record, and communicate mathematical ideas; and develop a repertoire of mathematical representations that can be used purposely, flexibly, and appropriately.

**Grade/Level:**

Grades 3 and 4

**Duration/Length**

4 to 5 class periods

**Prerequisite Knowledge:**

Students should have working knowledge of the following skills:

- Copying, continuing, and describing patterns
- Creating and identifying basic patterns
- Basic computer skills
- Working cooperatively
- Using repeated addition and multiplication
- Basic addition and subtraction facts

**Student Outcomes:**

Students will be able to:

- recognize and use the inverse relationships between addition/subtraction and multiplication/division to complete a function table.
- recognize and describe patterns formed using concrete objects, tables and pictures to extend patterns.
- analyze a given pattern formed by using objects and pictures and create a pattern with the same attributes.
- use a computer to generate a story slide show incorporating patterns.

## Materials/Resources:

- Beans (lima, pinto, kidney)
- Paper clips
- Straws
- Kid Pix (or slide show program)
- T-108 calculator
- Overhead calculator
- Sentence strips
- Markers
- Overhead projector
- Half sheets of paper
- Chart paper
- Index cards
- Star patterns
- Star stickers
- Computer
- Transparencies of Teacher Resource Sheets 1-6
- Student worksheet

## Development/Procedures:

### Day 1:

#### Task 1

Teacher materials: overhead, items such as: beans, paper clips, straws, Teacher Resource Sheet #1

Student materials: workmat, items such as: beans, paper clips, straws, pencil, paper

\*\* The class will be arranged in groups of four prior to the unit.

The teacher presents patterns on the overhead using three items from the materials list (beans, paper clips, straws). Using the half sheets of paper, students will write down three things that they notice about this pattern (wait time: 3 - 5 minutes). Students will have a dialogue with the class. The teacher will rearrange the same items and create a different pattern and again ask the students to discuss the pattern after writing three things about it. Together the class will come up with a **rule** so that the pattern can be reproduced.

Sample: (1) You may use 3 different items and 3 of each.

(2) The first **term** will repeat.

(3) The **core** has four terms.

(4) The core ends with a paper clip.

Example:

Core → heart=lima, diamond=kidney, club=paper clip

Term = ✓



\*\* During the course of discussion the teacher will write up new math vocabulary during the lesson. The words in bold should be on the chart. Refer to them throughout the lesson so that the students will not only understand the meaning, but how the words are used.

## Task 2

Teacher materials: overhead, beans, straws, paper clips,

Student materials: work mat, beans, straws, paper clips, paper, pencils

Students will work in their cooperative groups. Students will pick a color from the choices of red, blue, green or yellow. The color determines the role at the table. Red is the manager, blue is the materials person, yellow is the recorder and green is the reporter.

Display the following set of instructions on the overhead for the students to follow in their cooperative groups (see Teacher Resource Sheet #2 )

- Select 3 different items and five of each from the collection of materials.
- Create a pattern with the pieces.
- Write down a set of instructions (4), one on each card, on how to discover the pattern.
- Students send their cards to another group to solve (making sure they are labeled correctly).
- The solving group will present what they believe is the solution to the class (Reporter).

## Day 2:

### Task 1

Teacher materials: transparencies, overhead projector, overhead calculator

Student materials: calculator, paper

\*\* Guide students through a short review of the on/c , =, and + on the calculator. Allow students to have a few moments of facilitated play. Using the overhead calculator, show students how to develop a constant.

\*\* Elicit words to describe a **rule** to find the **input** when you know the **output**. Write in the numbers on the function chart. Explain that the purpose of the chart is to show how the input and output relate.

\*\* Develop the word **relationship** into the math vocabulary by discussing the inverse operations.

**Key Questions:**

Who has the power? The calculator or YOU? (You)

What's the relationship between the input and output?

What do you think the 8th input will be? What do you think the output will be if the input is 20?

\*\* As the students use the calculator, create a function table and fill in the numbers with them.

Example: Function Table

<u>Input</u>	<u>Output</u>
5	10
6	12

**Task 2 -- Study the Stars**

Teacher materials: overhead, ,star shapes

Student materials: Calculator, paper, sheet of star stickers

Each group receives a sheet of star stickers

\*\* Material person will get the materials necessary to complete the task.

Place star pattern on the overhead. Set a function table below it.

**Key Questions:**

How many points are on one star? (5)

How many points would be on two stars? (10)

What is being compared? (stars and points)

How many points will be on 20 stars? (100) 50 stars ? (250)

On the over head, begin to fill in the table, only after receiving feed back from the class. The students will also label one side of the paper **Stars** and the other side **Points**. As a group, the students will place the stars in the table, and the recorder (from the previous day) will fill in the function table as the members work cooperatively to complete the task.

Example:

<u>Stars</u>	<u>Number of Points</u>
★	5
★★	10

### **Day 3:**

#### **Task 1 --*Patterns in Literature***

Teacher materials: story transparency of Sad Sam by: Charlotte Burton, Teacher Resource Sheet #3

Student materials: paper , pencil, story The Little Red Hen retold by: Veronica Hutchinson, calculators

Read Sad Sam.

Teacher: Questions for students (also see Teacher Resource Sheet #4)

- (1) What part of the story was repeated?
- (2) What is the pattern?
- (3) How many items are in the core?
- (4) How many items would there be if the pattern repeated twice? Four times?
- (5) Set up a function table.
- (6) What are the inputs and outputs for the table?

Students will set up function table individually and complete at least six entries.

#### **Task 2**

Each group will be given a copy of the story, The Little Red Hen.

\*\* Place the questions on the overhead, using a transparency of Teacher Resource Sheet #4. Each group will develop a function table based on the pattern in the story. The function table must have at least 8 entries for input and output.

### **Day 4:**

#### **Task 1**

Teacher materials: presentation system, Kid Pix (slide show program), transparency of “Vignette” (Teacher Resource Sheet #5)

Student materials: computer, handwritten story

This problem solving vignette can be used as the culminating project for this learning unit. Students will begin formulating a story using patterns. They may approach writing the story by incorporating picture, word or numbers patterns. They must provide a function table to accompany their story. The Core must repeat at least three times.

### **Day 5:**

Students will present the slide shows to the class.

\*\* Students will do peer evaluations. Make a transparency or post the scoring rubric. (Teacher Resource Sheet #6)

**Performance Assessment:**

Students will be evaluated on the following criteria:

- Class discussion
- Group participation and performance
- Written responses
- Daily anecdotal records - integration into other subjects throughout the year, e.g., patterns in nature, literature, etc.
- Story slide show and the creation of the function table
- Peer evaluations

**Extension/Follow Up:**

For the duration of this unit, the classroom center will provide students with the opportunity to work with patterns during choice time.

- Students can design patterns on sentence strips (Be sure to include the answer to the pattern on the back.).
- Students can make pattern jewelry.
- Students can identify patterns in popular songs and poems.

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- (1) You may use 3 different items and 3 of each.
- (2) The first **term** will repeat.
- (3) The **core** has four terms.
- (4) The core ends with a paper clip.



- Select 3 different items and five of each from the collection of materials. (Materials)
- Create a pattern with the pieces.
- Write down a set of instructions (4), one on each card, on how to discover the pattern. (Recorder)
- Send your cards to another group to solve, making sure they are labeled correctly. (Manager)
- The solving group will present to the class what they believe is the solution and how they solved the problem. (Reporter)

## SAD SAM

by: Charlotte A. Burton

Sad Sam was so unhappy. He had no toys. It wasn't always this way. Sam used to have a lot of toys. Grandma had given him two choo-choo trains with loud whistles. Uncle Lou had sent him three stuffed elephants from Africa. His best friend, Mike, had given him five special marbles.

One day his icky cousin, Marvin, came to visit for a week. Sam's toys started to disappear. On the second day of Marvin's visit, Sam could not find his two choo-choo trains with loud whistles, his three stuffed elephants from Africa, or his five special marbles. Sam asked his icky cousin, Marvin, about his missing toys but Marvin said that he had seen nothing. Although late that night, Sam was sure he heard a train whistle.

Sam was so sad. Even though he still had a baseball, bat and glove, a puzzle, toy cars, and a light-up yo-yo to play with, he still missed his two choo-choo trains with loud whistles, his three stuffed elephants from Africa, and his five special marbles.

The day came for Marvin to go back home. While Marvin was hugging Aunt Mary, shaking hands with Uncle Joe, petting Max, the cat, and getting juicy kisses from Grandma, Sam took a peek in Marvin's suitcase. There, under a pair of smelly old socks, Sam found his two choo-choo trains with loud whistles, his three stuffed elephants from African and his five special marbles. Sam was not sad anymore. From then on Sam kept his two choo-choo trains with loud whistles, his three stuffed elephants from Africa, and his five special marbles in a safer place -- right in bed beside him.

- (1) What part of the story was repeated?
- (2) What is the pattern?
- (3) How many items are in the core?
- (4) How many items would there be if the pattern repeated twice? Four times?

# Vignette **Attention!**

**Pete the Pattern Eater has broken into the school library. He's devoured all the patterns found in some of our favorite stories. No more, Not I, and very well in The Little Red Hen. Good-bye 3 Billy Goats Gruff. We can't even catch the "Gingerbread Man"! We need your help. You are asked to create a story. You must include a pattern of numbers, words, or figures. The core must be repeated at least 3 times. Good Luck! Our readers are depending on you.**

## Rubric for Story Presentation

3 😊

- Slide show complete (at least 6 slides)
- Pattern repeated more than 2 times
- Complete sentences
- Presented sequentially

2 ✓

- Slide show complete (at least 4 - 5 slides)
- Pattern completed and repeated at least twice
- Complete sentences
- Presented sequentially

1 😞

- Created slide show
- Story line incomplete
- Pattern does not repeat

## Function Table

(Title 1)

(Title 2)